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PATENT & TRADEMARK OFFICE

TRANSMITTAL OF APPEAL BRIEF (Small Entity)	Docket No. POM-12402/29

In Re Application Of: **Mazumder et al**

Serial No.	Filing Date	Examiner	Group Art Unit
09/917,096	**July 27, 2001**	**E. Fuller**	**1762**

Invention: **FABRICATION OF CUSTOMIZED, COMPOSITE, AND ALLOY-VARIANT COMPONENTS USING CLOSED-LOOP DIRECT METAL DEPOSITION**

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on: **December 14, 2003**

Applicant is a small entity under 37 CFR 1.9 and 1.27.

A verified statement of small entity status under 37 CFR 1.27:

- ☐ is enclosed.
- ☐ has already been filed in this application.

The fee for filing this Appeal Brief is: **$165.00**

- ☒ A check in the amount of the fee is enclosed.
- ☐ The Director has already been authorized to charge fees in this application to a Deposit Account.
- ☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **07-1180**

Signature

Dated: **Dec. 15, 2003**

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I certify that this document and fee is being deposited on 12-15-03 with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Sheryl L. Hammer

Signature of Person Mailing Correspondence

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Typed or Printed Name of Person Mailing Correspondence

cc:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of: Mazumder et al.

Serial No.: 09/917,096 Group No.: 1762

Filed: July 27, 2001 Examiner: E. Fuller

For: FABRICATION OF CUSTOMIZED, COMPOSITE, AND ALLOY-VARIANT COMPONENTS USING CLOSED-LOOP DIRECT METAL DEPOSITION

APPELLANT'S BRIEF UNDER 37 CFR §1.192

Mail Stop Appeal Brief
Commissioner for Patents
PO Box 1450
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Dear Sir:

I. Real Party in Interest

The real party and interest in this case is The P.O.M. Group, a Michigan corporation, by assignment.

II. Related Appeals and Interferences

There are no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

The present application was filed with 20 claims. Claim 10 has been canceled; accordingly, claims 1-9 and 11-20 are pending and under appeal.

IV. Status of Amendments Filed Subsequent Final Rejection

No after-final amendments have been filed.

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V. Concise Summary of the Invention

Broadly, this invention utilizes a laser-assisted, direct metal deposition (DMD^{tm}), preferably in a closed-loop arrangement, to fabricate designed articles and tools such as molds and tools with improved properties. According to the method, a substrate is provided having a surface, onto which a layer of a material is deposited having the desired characteristic using the laser-assisted DMD process (Specification, page 3, lines 11-15).

In different embodiments, the substrate/layer combination may be tailored for improved wear resistance, thermal conductivity, density/hardness, corrosion and/or resistance to corrosion, oxidation or other undesirable effects (Specification, page 3, lines 16-18). Alternatively, the layer of material may be tailored to have a phase which is different from that of the substrate. In particular, the layer material itself may be chosen to promote a phase which is different from that of the substrate (Specification, page 3, lines 18-21).

In the preferred embodiment, a closed-loop, laser-assisted DMD process is deployed to build the substrate on an incremental basis (Specification, page 4, lines 1-2). To enhance throughput, the substrate and/or outer layer(s) of material may be fabricated using a robotic closed-loop DMD arrangement. In concert with the improvements made possible through the tailored outer layer(s), the method may further include the step of incorporating one or more conformal cooling channels within the component or the formation of one or more conductive heat sinks or thermal barriers during the DMD fabrication of the component itself (Specification, page 4, lines 2-7).

VI. Concise Statement of Issues Presented For Review

1. Are claims 1-9 and 14-18 unpatentable under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al.?

2. Are claims 12 and 13 unpatentable under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7 above, and further in view of U.S. Patent No. 5,952,057 to Parks?

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3. Are claims 19 and 20 unpatentable under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7 above, and further in view of U.S. Patent No. 5,875,930 to Singer et al.?

VII. Grouping of Claims for Each Ground of Rejection Which Appellant Contends

Appellant believes the following groups of claims represent patentably distinct inventions which should be given independent consideration on appeal:

Group I: Claims 1, 4, 5, 7, 8, 14 and 17, wherein claims 4, 5, 7, 8, 14 and 17 stand or fall with claim 1;

Group II: Claims 2 and 15;

Group III: Claims 3 and 16;

Group IV: Claims 6 and 18;

Group V: Claim 9;

Group VI: Claim 11;

Group VII: Claim 12;

Group VIII: Claim 13;

Group IX: Claim 19; and

Group X: Claim 20.

VIII. Argument

A. Group I - Claims 1, 4, 5, 7, 8, 14 and 17, wherein claims 4, 5, 7, 8, 14 and 17 with claim 1

Claims 1 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Lewis resides in a method and apparatus for forming articles from materials in particulate form in which the materials are melted by a laser beam and deposited at points along a tool path to form an article of the desired shape and dimensions. Preferably the tool path and other parameters of the deposition process are established using computer-aided design and manufacturing techniques. A controller comprised of a digital computer directs movement of a deposition zone along the tool path and provides control signals to adjust apparatus

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functions, such as the speed at which a deposition head which delivers the laser beam and powder to the deposition zone moves along the tool path.

The Examiner concedes that "[t]he reference fails to teach the optical monitoring for feedback control," thereby combining Lewis and Jeantette et al.

According to Jeantette, a method and system are provided for producing complex, three-dimensional, net-shape objects from a variety of powdered materials. The system includes various components to ensure a uniform and continuous flow of powdered materials and to focus and locate the flow of powdered materials with respect to a laser beam which results in the melting of the powdered material. The system also includes a controller so that the flow of molten powdered materials can map out and form complex, three-dimensional, net-shape objects by layering the molten powdered material. Advantageously, such complex, three-dimensional net-shape objects can be produced having material densities varying from 90 percentage of theoretical to fully dense, as well as a variety of controlled physical properties. Additionally, such complex, three-dimensional objects can be produced from two or more different materials so that the composition of the object can be transitioned from one material to another.

Claim 1 includes, *inter alia*, the step of "automatically controlling the <u>physical dimension</u> in accordance with the description of the article to be fabricated based upon feedback derived through the optical monitoring;" (Emphasis added.)

The Examiner argues that Jeantette teaches "that optical monitoring is used ..." citing column 8, lines 28-40. However, the "feedback" system of Jeantette et al. is very different from that of Appellants, in that rather than monitoring <u>the dimension</u> of a deposit, a triangulation system is used *to estimate* layer thickness as a function of the energy input to a particular location. "Experimental data suggests that the deposition layer thickness increases nearly linearly with increasing volumetric exposure." The triangulation device is mounted such that an output signal is generated that is proportional to the height of the forming structure. "This will typically correspond to the position where the deposition beam B is at short focus on the deposition stage S." (See column 9, lines 2-5). Thus, Jeantette does not teach the limitations of optically monitoring the physical dimension, and automatically controlling <u>the physical dimension</u> in accordance with the description of an article to be fabricated. Thus, even with the addition of the Lewis reference, the Lewis/ Jeantette combination fails to teach all the elements of claim 1.

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B. Group II - Claims 2 and 15

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 2 adds to claim 1 that "the material of the layer is specifically chosen to promote a phase which is different from that of the substrate." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

C. Group III - Claims 3 and 16

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 3 adds to claim 1 " the step of using non-equilibrium synthesis to dissolve a low-solubility material into the layer of material to increase its hardness." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

D. Group IV - Claims 6 and 18

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 6 adds to claim 1 "the step of applying the layer of material using a robotic, closed-loop process..." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie*

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obviousness has not been established.

E. Group V - Claim 9

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 9 adds to claim 7 that "the different material is more thermally conductive than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

F. Group VI - Claim 11

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 11 adds to claim 7 that "the different material has a density greater than that of the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

G. Group VII - Claim 12

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 12 adds to claim 7 that "the different material is more resistant to corrosion than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or

elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

H. Group VIII - Claim 13

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 13 adds to claim 7 that "the different material is more resistant to oxidation than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

I. Group IX - Claim 19

Claim 19 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7, and further in view of U.S. Patent No. 5,875,930 to Singer et al. Again, while it is believed that claims 19 and 20 should be deemed independently allowable due to the amendment to the claim from which they depend, Appellants believe the combination of Lewis et al. and Singer et al. is unjustified. Singer teaches a tool used for high-pressure die casting, and fails to disclose any method of the sort that Lewis teaches in terms of fabrication. In fact, the technique described by Singer resides in a deposition of a single steel layer (3) followed by a single copper layer (4) on a die or mold surface using a spray molten metal technique. Alternatively, Singer proposes metal spray deposition of alternating copper and tool steel materials followed by machining (drilling) of the cooling channels in the fabricated structure. As such, *alloying*, as well would be understood of any one of skill in the art, is simply not taught.

It is well settled, however, that in order to sustain an obviousness rejection there must be a reason why one having ordinary skill in the pertinent art would have been led to combine references to arrive at Appellants' claimed invention. Moreover, there must be something *in the prior art* that suggests the proposed modification, other than the hindsight gained from knowledge that the inventor

choose to combine these particular things in this particular way. Uniroyal Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988). The Examiner is further required to make specific findings on a suggestion to combine prior art references. In Re Dembeczak, 175 F.3d 994, 1000-01, 50 USPQ2d 1614, 1617-19 (Fed. Cir. 1999).

In this case, there is no teaching or suggestion whatsoever in Singer et al. to use the process of Lewis, and, in fact, there *is* disclosure regarding processes *other than that disclosed by Lewis.* Furthermore, even if Singer and Lewis were combined, Appellants' claimed process would not result, given the use of feedback control used to monitor a physical characteristic of the alloy being deposited, an aspect about which both references, even in combination, are silent.

J. Group X - Claim 20

Claim 20 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7, and further in view of U.S. Patent No. 5,875,930 to Singer et al. Claim 20 adds to claim 7 "the step of incorporating one or more conductive heat sinks or thermal barriers in the component during the fabrication thereof." Appellant can find to teaching in Lewis or elsewhere in the cited art which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

Conclusion

In conclusion, for the arguments of record and the reasons set forth above, all pending claims of the subject application continue to be in condition for allowance and Appellant seeks the Board's concurrence at this time.

Respectfully submitted,

By: ____________________

Date: Dec. 15, 2003

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APPENDIX A

CLAIMS ON APPEAL

1. A method of fabricating a component having improved properties, comprising the steps of:

a) providing a substrate having a surface;

b) providing a description of the component to be fabricated,

c) heating a region of the component with a laser sufficient to form a localized meltpool;

d) feeding material into the meltpool to deposit a layer having a physical dimension;

e) optically monitoring the physical dimension;

f) automatically controlling the physical dimension in accordance with the description of the article to be fabricated based upon feedback derived through the optical monitoring; and

wherein, compared to the substrate, the layer of material exhibits:

improved resistance to wear, corrosion, or oxidation,

improved thermal conduction,

greater density, or

a different phase.

2. The method of claim 1, wherein the material of the layer is specifically chosen to promote a phase which is different from that of the substrate.

3. The method of claim 1, further including the step of using non-equilibrium synthesis to dissolve a low-solubility material into the layer of material to increase its hardness.

4. The method of claim 1, wherein the step of providing a substrate having a surface includes the step of using direct metal deposition to build the substrate on an incremental basis.

5. The method of claim 1, wherein the substrate and layer comprise a die, mold or other tool.

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6. The method of claim 1, further including the step of applying the layer of material using a robotic, closed-loop process involving steps c) through f).

7. A method of fabricating a component having improved properties, comprising the steps of:

a) providing a computer-aided design (CAD) description of a component having an outer surface to be fabricated;

b) feeding material into a laser-heated meltpool to deposit material increments with physical dimensions until the component is fabricated according to the description;

c) optically monitoring the physical dimensions;

d) automatically controlling the physical dimensions in accordance with the optical monitoring to match the CAD description more accurately; and

e) depositing one or more additional layers of different material having a desired characteristic onto at least a portion of the outer surface of the fabricated component, using steps b) through d), above, to deposit the different material.

8. The method of claim 7, wherein the different material exhibits improved wear resistance relative to the component.

9. The method of claim 7, wherein the different material is more thermally conductive than the component itself.

11. The method of claim 7, wherein the different material has a density greater than that of the component itself.

12. The method of claim 7, wherein the different material is more resistant to corrosion than the component itself.

13. The method of claim 7, wherein the different material is more resistant to oxidation than

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the component itself.

14. The method of claim 7, wherein the different material has a phase which is different from that of the component itself.

15. The method of claim 14, further including the step of choosing the different material to promote a phase which is different from that of the substrate.

16. The method of claim 7, further including the step of using non-equilibrium synthesis to dissolve low a solubility material into the layer of material to increase hardness.

17. The method of claim 7, wherein the component is a die, mold or other tool.

18. The method of claim 7, further including the step of applying the layer of material using a robotic, closed-loop process involving steps b) through e).

19. The method of claim 7, further including the step of incorporating one or more conformal cooling channels within the component during its fabrication.

20. The method of claim 7, further including the step of incorporating one or more conductive heat sinks or thermal barriers in the component during ~~its~~ the fabrication thereof.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
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Mail Stop Appeal Brief
Commissioner for Patents
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Dear Sir:

I. Real Party in Interest

The real party and interest in this case is The P.O.M. Group, a Michigan corporation, by assignment.

II. Related Appeals and Interferences

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No after-final amendments have been filed.

V. Concise Summary of the Invention

Broadly, this invention utilizes a laser-assisted, direct metal deposition (DMD™), preferably in a closed-loop arrangement, to fabricate designed articles and tools such as molds and tools with improved properties. According to the method, a substrate is provided having a surface, onto which a layer of a material is deposited having the desired characteristic using the laser-assisted DMD process (Specification, page 3, lines 11-15).

In different embodiments, the substrate/layer combination may be tailored for improved wear resistance, thermal conductivity, density/hardness, corrosion and/or resistance to corrosion, oxidation or other undesirable effects (Specification, page 3, lines 16-18). Alternatively, the layer of material may be tailored to have a phase which is different from that of the substrate. In particular, the layer material itself may be chosen to promote a phase which is different from that of the substrate (Specification, page 3, lines 18-21).

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VI. Concise Statement of Issues Presented For Review

1. Are claims 1-9 and 14-18 unpatentable under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al.?

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Appellant believes the following groups of claims represent patentably distinct inventions which should be given independent consideration on appeal:

Group I: Claims 1, 4, 5, 7, 8, 14 and 17, wherein claims 4, 5, 7, 8, 14 and 17 stand or fall with claim 1;

Group II: Claims 2 and 15;

Group III: Claims 3 and 16;

Group IV: Claims 6 and 18;

Group V: Claim 9;

Group VI: Claim 11;

Group VII: Claim 12;

Group VIII: Claim 13;

Group IX: Claim 19; and

Group X: Claim 20.

VIII. Argument

A. Group I - Claims 1, 4, 5, 7, 8, 14 and 17, wherein claims 4, 5, 7, 8, 14 and 17 with claim 1

Claims 1 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Lewis resides in a method and apparatus for forming articles from materials in particulate form in which the materials are melted by a laser beam and deposited at points along a tool path to form an article of the desired shape and dimensions. Preferably the tool path and other parameters of the deposition process are established using computer-aided design and manufacturing techniques. A controller comprised of a digital computer directs movement of a deposition zone along the tool path and provides control signals to adjust apparatus

functions, such as the speed at which a deposition head which delivers the laser beam and powder to the deposition zone moves along the tool path.

The Examiner concedes that "[t]he reference fails to teach the optical monitoring for feedback control," thereby combining Lewis and Jeantette et al.

According to Jeantette, a method and system are provided for producing complex, three-dimensional, net-shape objects from a variety of powdered materials. The system includes various components to ensure a uniform and continuous flow of powdered materials and to focus and locate the flow of powdered materials with respect to a laser beam which results in the melting of the powdered material. The system also includes a controller so that the flow of molten powdered materials can map out and form complex, three-dimensional, net-shape objects by layering the molten powdered material. Advantageously, such complex, three-dimensional net-shape objects can be produced having material densities varying from 90 percentage of theoretical to fully dense, as well as a variety of controlled physical properties. Additionally, such complex, three-dimensional objects can be produced from two or more different materials so that the composition of the object can be transitioned from one material to another.

Claim 1 includes, *inter alia*, the step of "automatically controlling the <u>physical dimension</u> in accordance with the description of the article to be fabricated based upon feedback derived through the optical monitoring;" (Emphasis added.)

The Examiner argues that Jeantette teaches "that optical monitoring is used . . ." citing column 8, lines 28-40. However, the "feedback" system of Jeantette et al. is very different from that of Appellants, in that rather than monitoring <u>the dimension</u> of a deposit, a triangulation system is used *to estimate* layer thickness as a function of the energy input to a particular location. "Experimental data suggests that the deposition layer thickness increases nearly linearly with increasing volumetric exposure." The triangulation device is mounted such that an output signal is generated that is proportional to the height of the forming structure. "This will typically correspond to the position where the deposition beam B is at short focus on the deposition stage S." (See column 9, lines 2-5). Thus, Jeantette does not teach the limitations of optically monitoring the physical dimension, and automatically controlling <u>the physical dimension</u> in accordance with the description of an article to be fabricated. Thus, even with the addition of the Lewis reference, the Lewis/ Jeantette combination fails to teach all the elements of claim 1.

B. <u>Group II - Claims 2 and 15</u>

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 2 adds to claim 1 that "the material of the layer is specifically chosen to promote a phase which is different from that of the substrate." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

C. <u>Group III - Claims 3 and 16</u>

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 3 adds to claim 1 " the step of using non-equilibrium synthesis to dissolve a low-solubility material into the layer of material to increase its hardness." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

D. <u>Group IV - Claims 6 and 18</u>

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 6 adds to claim 1 "the step of applying the layer of material using a robotic, closed-loop process..." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie*

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obviousness has not been established.

E. Group V - Claim 9

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 9 adds to claim 7 that "the different material is more thermally conductive than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

F. Group VI - Claim 11

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 11 adds to claim 7 that "the different material has a density greater than that of the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

G. Group VII - Claim 12

The claims of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 12 adds to claim 7 that "the different material is more resistant to corrosion than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or

elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

H. <u>Group VIII - Claim 13</u>

The claim of this group stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. Claim 13 adds to claim 7 that "the different material is more resistant to oxidation than the component itself." Although the Examiner cites col. 24, line 29 to col. 25, line 68 of Lewis as disclosing this limitation, it does not. Rather, this section of the Lewis reference discusses the problems associate with joining dissimilar materials and the use of interlayers, in particular for solving such problems. Appellant can find to teaching here or elsewhere in Lewis which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

I. <u>Group IX - Claim 19</u>

Claim 19 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7, and further in view of U.S. Patent No. 5,875,930 to Singer et al. Again, while it is believed that claims 19 and 20 should be deemed independently allowable due to the amendment to the claim from which they depend, Appellants believe the combination of Lewis et al. and Singer et al. is unjustified. Singer teaches <u>a tool</u> used for high-pressure die casting, and fails to disclose any method of the sort that Lewis teaches in terms of fabrication. In fact, the technique described by Singer resides in a deposition of a single steel layer (3) followed by a single copper layer (4) on a die or mold surface using a spray molten metal technique. Alternatively, Singer proposes metal spray deposition of alternating copper and tool steel materials followed by machining (drilling) of the cooling channels in the fabricated structure. As such, *alloying*, as well would be understood of any one of skill in the art, is simply not taught.

It is well settled, however, that in order to sustain an obviousness rejection there must be a reason why one having ordinary skill in the pertinent art would have been led to combine references to arrive at Appellants' claimed invention. Moreover, there must be something *in the prior art* that suggests the proposed modification, other than the hindsight gained from knowledge that the inventor

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choose to combine these particular things in this particular way. Uniroyal Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988). The Examiner is further required to make specific findings on a suggestion to combine prior art references. In Re Dembeczak, 175 F.3d 994, 1000-01, 50 USPQ2d 1614, 1617-19 (Fed. Cir. 1999).

In this case, there is no teaching or suggestion whatsoever in Singer et al. to use the process of Lewis, and, in fact, there *is* disclosure regarding processes *other than that disclosed by Lewis.* Furthermore, even if Singer and Lewis were combined, Appellants' claimed process would not result, given the use of feedback control used to monitor a physical characteristic of the alloy being deposited, an aspect about which both references, even in combination, are silent.

J. Group X - Claim 20

Claim 20 stands rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,837,960 to Lewis in view of U.S. Patent No. 6,046,426 to Jeantette et al. as applied to claim 7, and further in view of U.S. Patent No. 5,875,930 to Singer et al. Claim 20 adds to claim 7 "the step of incorporating one or more conductive heat sinks or thermal barriers in the component during the fabrication thereof." Appellant can find to teaching in Lewis or elsewhere in the cited art which are specifically directed to the claim limitations of this group. Accordingly, *prima facie* obviousness has not been established.

Conclusion

In conclusion, for the arguments of record and the reasons set forth above, all pending claims of the subject application continue to be in condition for allowance and Appellant seeks the Board's concurrence at this time.

Respectfully submitted,

By: ______________________

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APPENDIX A

CLAIMS ON APPEAL

1. A method of fabricating a component having improved properties, comprising the steps of:

a) providing a substrate having a surface;

b) providing a description of the component to be fabricated,

c) heating a region of the component with a laser sufficient to form a localized meltpool;

d) feeding material into the meltpool to deposit a layer having a physical dimension;

e) optically monitoring the physical dimension;

f) automatically controlling the physical dimension in accordance with the description of the article to be fabricated based upon feedback derived through the optical monitoring; and

wherein, compared to the substrate, the layer of material exhibits:

improved resistance to wear, corrosion, or oxidation,

improved thermal conduction,

greater density, or

a different phase.

2. The method of claim 1, wherein the material of the layer is specifically chosen to promote a phase which is different from that of the substrate.

3. The method of claim 1, further including the step of using non-equilibrium synthesis to dissolve a low-solubility material into the layer of material to increase its hardness.

4. The method of claim 1, wherein the step of providing a substrate having a surface includes the step of using direct metal deposition to build the substrate on an incremental basis.

5. The method of claim 1, wherein the substrate and layer comprise a die, mold or other tool.

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6. The method of claim 1, further including the step of applying the layer of material using a robotic, closed-loop process involving steps c) through f).

7. A method of fabricating a component having improved properties, comprising the steps of:

a) providing a computer-aided design (CAD) description of a component having an outer surface to be fabricated;

b) feeding material into a laser-heated meltpool to deposit material increments with physical dimensions until the component is fabricated according to the description;

c) optically monitoring the physical dimensions;

d) automatically controlling the physical dimensions in accordance with the optical monitoring to match the CAD description more accurately; and

e) depositing one or more additional layers of different material having a desired characteristic onto at least a portion of the outer surface of the fabricated component, using steps b) through d), above, to deposit the different material.

8. The method of claim 7, wherein the different material exhibits improved wear resistance relative to the component.

9. The method of claim 7, wherein the different material is more thermally conductive than the component itself.

11. The method of claim 7, wherein the different material has a density greater than that of the component itself.

12. The method of claim 7, wherein the different material is more resistant to corrosion than the component itself.

13. The method of claim 7, wherein the different material is more resistant to oxidation than

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the component itself.

14. The method of claim 7, wherein the different material has a phase which is different from that of the component itself.

15. The method of claim 14, further including the step of choosing the different material to promote a phase which is different from that of the substrate.

16. The method of claim 7, further including the step of using non-equilibrium synthesis to dissolve low a solubility material into the layer of material to increase hardness.

17. The method of claim 7, wherein the component is a die, mold or other tool.

18. The method of claim 7, further including the step of applying the layer of material using a robotic, closed-loop process involving steps b) through e).

19. The method of claim 7, further including the step of incorporating one or more conformal cooling channels within the component during its fabrication.

20. The method of claim 7, further including the step of incorporating one or more conductive heat sinks or thermal barriers in the component during ~~its~~ the fabrication thereof.